

Zero Retries issue 0208 2025-06-27

Zero Retries is an independent newsletter promoting technological innovation in and adjacent to Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2800+ subscribers.

About Zero Retries

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On the web: <https://www.zeroretries.org/p/zero-retries-0208>

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In this issue:

Request To Send

- Paid Subscribers Update
- Weekends Are For Amateur Radio! Ham Holiday Weekend in Europe and the US

ZRDC 2025 Registration Now Open

AST SpaceMobile Lays Claim to 430-440 MHz and 902-928 MHz for Commercial Satellite Communications in FCC Filing

- FCC Accepting Comments Through 2025-07-21, Reply Comments Through 2025-08-05
- Additional Coverage of This Story

Details About Data Over DMR

2025 June - State of the APRS Foundation (YouTube)

- Newly “Elected” APRSF Directors (see slide at 7:09)
- Contacting APRS Foundation With Your Input
- Consolidating the Many “Variants” of APRS Specifications

ZR > BEACON

- Update on “Available for Amateur Radio” Power Amplifiers
- QRadioLink - Multimode Software Defined Transceiver Application
- HackRF Pro Announced (Pre-purchase)

- Checking in on the Universal Radio Test Instrument (URTI) Project
- TETRA Supports Single Frequency Repeater Mode

Comments Summary From Previous Issue

Zero Retries Boilerplate

Permission for Reuse of Zero Retries Content

Keywords for this Issue

Footnotes for this Issue

Comments for This Issue (redirect to Comments page)

Request To Send

Commentary by Editor Steve Stroh N8GNJ

Paid Subscribers Update

My thanks to **Rick Gilmore W3TM** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Eric Stammers M0REQ** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Prefers to Remain Anonymous 34** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Stuart Whiting WS7SW** for *upgrading* from a free subscriber to Zero Retries to an **Annual Paid Subscriber** this past week!

My thanks to **Prefers to Remain Anonymous 75** for becoming a **Paid Subscriber** to Zero Retries this past week!

Financial support from Zero Retries readers is a significant vote of support for the continued publication of Zero Retries.

###

Weekends Are For Amateur Radio! Ham Holiday Weekend in Europe and the US

For Amateur Radio Operators in Europe, this weekend is the [International Amateur Radio Exhibition](#), more widely known in Amateur Radio as **HAM RADIO Friedrichshafen...** or just “**Friedrichshafen**”.

The motto of this year's HAM RADIO in Friedrichshafen, “REMOTE RADIO - CONNECTING THE WORLD”, demonstrates in a unique way that amateur radio is on the pulse of the times.

Where previously the radio operator needed to be physically present with their equipment, remote operation now allows transmission from anywhere. This is defined in the amateur radio regulations as the “unmanned, remote-controlled operation of a fixed amateur radio station” by a licensed amateur radio operator. The respective station is controlled remotely over the Internet.

One of the advantages of remote operation is that it allows amateur radio operators who are unable to set up a station and, in particular, an antenna at their place of residence, to operate. In the event of a disaster, remote stations can be used as emergency radio stations, replacing destroyed but essential communication structures. In educational settings, they can help to teach amateur radio technology to

students, with minimal technical effort required. In addition, many other opportunities for radio experimentation become possible – including radio operation where people cannot or do not wish to stay for an extended period of time.

The “extended radio” therefore has many benefits. You can experience it first hand at HAM RADIO!

I browsed through the exhibitor list of HAM RADIO 2025, and didn’t find much detail. That said, I was surprised at the number of test and measurement equipment vendors that want to showcase their products specifically to Amateur Radio Operators. I don’t recall a similar effort for (US) Hamvention 2025. There also seem to be a number of Amateur Radio organizations from all over Europe exhibiting at HAM RADIO. I look forward to hopefully visiting HAM RADIO in the next few years, and seeing these exhibitors for myself, most of which I would never see represented in the US.

For Amateur Radio Operators in the US, this weekend is [ARRL Field Day 2025](#), the closest thing to an Amateur Radio holiday in the US.

Field Day is ham radio's open house. Every June, more than 31,000 hams throughout North America set up temporary transmitting stations in public places to demonstrate ham radio's science, skill and service to our communities and our nation. It combines public service, emergency preparedness, community outreach, and technical skills all in a single event. Field Day has been an annual event since 1933, and remains the most popular event in ham radio.

Between recent travels and lots of work on the **Zero Retries Digital Conference** (read below) and of course, Zero Retries, and other personal busyness, I don’t have plans for participating in Field Day 2025... though I was tempted by the impressive coordination that obviously went into [Seattle Radio Field Day 2025](#) which is a joint event by:

[Puget Sound Repeater Group](#), the [West Seattle Amateur Radio Club](#), the [Seattle Auxiliary Communications Service](#), and [Cascadia Radio](#).

The weather oracle on my pocket computer predicts sunshine and moderate temperatures for Bellingham and our temperate corner of the continent.

Thus I plan to spend this weekend doing more work on various projects in N8GNJ / Zero Retries Labs, especially now that all the parts for a planned project have finally arrived and I can *finally* get stated on *that* project. And finally unpacking my [HF Signals zBitx](#) that arrived just before my trip to Hamvention. Or perhaps I’ll finally fix my antenna pole that was bent this past winter by the *Wicked Whatcom Winter Winds*.

Next year, after several years of preparation, I ~~hope~~ plan to participate in both [Winter Field Day](#) and ARRL Field Day with a modest personal portable (capable) station... my version of a Go Kit... operating on emergency power (solar panel with a battery) operating some data mode on low power (under 50 watts). It sounds like by then ARRL’s Logbook of the World will have received a long overdue update and will probably be easier (and more reliable) to use. Thus any contacts I make during those events won’t be “throwaway” (as has happened with groups I’ve participated with during past years) for not having been uploaded and thus confirmable.

So, whether you’re in Europe at HAM RADIO, or in North America participating in Field Day, or like me working on interesting Amateur Radio projects, have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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Image courtesy of Zero Retries Digital Conference 2025

ZRDC 2025 Registration Now Open

By Tina Stroh KD7WSF
Zero Retries Digital Conference Manager

Registration for the inaugural Zero Retries Digital Conference (ZRDC) 2025 is now open!

[Click here to register for ZRDC 2025](#)

Registration offers in-person access and virtual attendance options to attend the inaugural Zero Retries Digital Conference 2025. Ticket price descriptions state what is included with each level of participation. Such as, in-person attendance includes access to the conference along with conference proceedings, welcome refreshments, refreshments throughout the day, buffet lunch and a chance to win raffle prizes.

Welcome refreshments will include fresh fruit with a Greek yogurt dip, assorted pastries, muffins, doughnuts and scones, and assorted bagels with butter, cream cheese and preserves. Coffee, hot tea, and juice will be available.

The buffet lunch will consist of a green and Southwest style salad, deli sandwich display of turkey, ham, and roast beef with cheddar, swiss, and provolone cheeses, various condiments, assorted deli breads, deli wraps, roasted veggies, polenta bar, apple crumble and brownies. Beverage choices of coffee, tea, iced tea, and lemonade will be offered.

Throughout the day, coffee service, lemonade and fruit infused water will be available.

Just a reminder...

ZRDC 2025 will be held on **Saturday September 13th, 2025** at the same venue as the [GNU Radio Conference \(GRCon\) 2025](#) - the [Edward D. Hansen Conference Center](#) in downtown Everett.

GRCon 2025 will be held Monday September 8th through Friday, September 12th, 2025.

While GRCon 2025 and ZRDC 2025 are being held consecutively at the same venue, the two events are independent of each other.

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AST SpaceMobile Lays Claim to 430-440 MHz and 902-928 MHz for Commercial Satellite Communications in FCC Filing

By Steve Stroh N8GNJ

This may well be the most significant challenge to date to one of Amateur Radio's most popular bands. It's particularly significant for Amateur Radio space communications, as that usage directly competes with this company's use case - satellite communications.

In [DA 25-532, released 2025-06-20](#), the FCC Space Bureau has accepted a filing from [AST SpaceMobile](#) to conduct Telemetry, Tracking, and Command (TT&C) in both space-to-Earth and Earth-to-space communications modes in 430-440 MHz. In the document, AST SpaceMobile is referenced as AST & Science, LLC (AST).

In the US, this 10 MHz band segment comprises the *middle third* of US Amateur Radio's (secondary¹) allocation of the very popular and heavily used 420-450 MHz (70 cm) band.

Also of interest, and potentially impacting US Amateur Radio operations in the 902-928 MHz band, AST also requests to use 902-928 MHz for space-to-Earth and 902-915 MHz for Earth-to-space communications.

In the US 902-928 MHz band, Amateur Radio has overlapping allocations with unlicensed operations in this very popular and also very heavily used band.

AST's request mentions a number of bands other than those in use by Amateur Radio.

AST intends to operate a number of satellites in Low Earth Orbit (LEO) with very large antennas that will allow typical mobile telephones to operate normally in areas where there is no terrestrial network coverage, operating on some of the same frequencies as terrestrial carriers.

AST intends to provide its satellite service [worldwide](#):

We are partnering with some of the largest mobile network operators across the globe to reach the biggest audience and improve connectivity worldwide. AST SpaceMobile's goal is to eliminate the connectivity gaps faced by today's 5 billion mobile subscribers and bring broadband to approximately half of the world's population who remain unconnected.

AST SpaceMobile has entered into agreements and understandings with over 50 mobile network operators which collectively service over 3 billion cellular customers.

In the US, AST's carrier partners are AT&T and Verizon. T-Mobile has announced a partnership with Starlink with similar technology (use of ordinary mobile phones via satellite) called [T-Satellite](#), which will begin commercial operation on 2025-07-23.

FCC Accepting Comments Through 2025-07-21, Reply Comments Through 2025-08-05

FCC DA 25-532 appears to be notification that the FCC Space Bureau has merely accepted AST's *request* to use these bands.

The FCC is now accepting comments:

Filing Requirements: Interested parties may file comments on or before July 21, 2025 and reply comments on or before August 5, 2025. Comments and petitions regarding this application should be filed in both the Commission's Electronic Comment Filing System (ECFS) and in International Communications Filing System (ICFS) under the appropriate file number. 47 CFR §25.154. All filings must refer to SB Docket No. 25-201 and ICFS File No. SAT-MOD-20250612-00145.

Per this mention by AMSAT-DL from 2022, AST has been operating in 430-440 MHz for some time:

[AST SPACEMOBILE CONSTELLATION IN 430-440 MHZ BAND](#)

This seems concerning, per this update in 2024 by DB2OS:

Although FCC confessed that the commercial 435 MHz TT&C operations do not fall within the ITU assigned classification for the amateur satellite service, they granted permission...

Additional Coverage of This Story

- [ANS-159 AMSAT News Service Weekly Bulletins - 2025-06-08: Satellite Shorts from All Over](#)

+ The FCC has denied AST Space Mobile's request to use 430 MHz -440 MHz for telemetry operations, noting "There is no space tracking or space telemetering allocation in the 430-440 MHz frequency range." (Thanks to AMSAT-DL and the FCC for the information)

Unfortunately, AMSAT did not provide a link to their source for the "denied" claim, and I haven't seen any additional confirmation. Note that FCC DA 25-532 was dated later (2025-06-20) than AMSAT's mention.

- [Peter Guelzow] DB2OS 2025-06-22 - [Bad News for the 70cm Amateur Radio Band](#)
- Amateur Radio Daily 2025-06-25 - [Satellite Communications Company AST SpaceMobile Seeks Use of 70 cm Amateur Band](#)
- AMSAT-UK 2025-06-26 - [Use of 430-440 MHz by AST SpaceMobile Constellation](#)
- [Amateur Radio Newline Report 2487 for Friday, June 27th, 2025](#) - Mobile Broadband Provider Seeks Amateur Frequencies For Satellites

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Details About Data Over DMR

By Adrian Octavian Musceac YO8RZZ

***Editor's Note** - What follows is a deep dive down a rabbit hole of obscure Amateur Radio technology. This subject has been mentioned numerous times in Zero Retries, and this article is a satisfying conclusion to my quest to understand this subject.*

Introduction by Steve Stroh N8GNJ; some reference info provided by ChatGPT

The raw data rate of Digital Mobile Radio (DMR), in a 12.5 kHz channel, is 9600 bps.

- The 9600 bps data rate is divided into two 4800 bps time slots in a Time Division Multiple Access (TDMA) system.
- Each 4800 bps stream includes voice encoding using AMBE+2 vocoder, which typically consumes around 2.45 kbps. The remaining data of each time slot is used for error correction, synchronization, signaling, and control data.
- Short messages (short text messages similar to Short Message Service - SMS on mobile devices) can be sent on DMR without needing to switch the radio to a "data-only" mode. Texts are transmitted using the control / signaling portion of the DMR protocol. Texts use either time slot, depending on availability and configuration. Texts are usually limited in size — often up to 140–255 characters, depending on implementation. Radios can send or receive texts even when not actively in voice use, or between voice use.
- In data-only use (such as IP data over DMR), the usable data rate is lower due to protocol overhead — approximately 2400 - 3600 bps of actual user data per time slot, depending on the implementation.

I've long been interested in the potential of sending data (arbitrary data such as files, not just text messages) via DMR because there are now hundreds, perhaps thousands of DMR repeaters deployed in Amateur Radio. But as I stated in **Zero Retries 0093** - Data / Packet Radio via DMR:

*It's frustrated me that the specification for Digital Mobile Radio (DMR) includes the capability for data exchange (and that DMR, by fundamental definition, is data communications), but **data** interoperability between various manufacturer's implementations of DMR has not been established. Thus "Data Over DMR" has been a nebulous concept in Amateur Radio (per my research to date) except for (10 key keypad) unit to unit text messaging and some position data transmissions ("APRS" over DMR). Note that the data being exchanged in this video are between two units of the same manufacturer (Motorola). I did some very brief (incomplete) research on the radios mentioned in this video, and they are expensive (intended for professional use). Despite that dis-recommendation for consideration for Amateur Radio use, it's good to see at least a reference demonstration that data communications are possible with DMR radios.*

That article linked to a [YouTube video - DMR Packet Radio?](#) which demonstrated that data can be exchanged over Motorola Mototrbo radios.

I can remember complaining in various issues of Zero Retries over the past nearly four years about the "data over DMR" issue, that data over DMR is nebulously defined in the DMR specification. Or rather that was my perception.

My most recent complaint was at the very end of an article in **Zero Retries 0207** - Amateur Radio's Lack of Imagination About Repeater Technology:

Now if we could only figure out how to use DMR for data communications without resorting to proprietary data over DMR systems like Motorola's and Hytera's.

...

In response to that statement, Adrian Octavian Musceac YO8RZZ wrote me a detailed email explaining about the potential use of data over DMR, including some questions, and their answers.

(End Introduction)

Hello Steve,

I frequently read your newsletter at Zero Retries, since you publish useful and interesting content. Thank you for that. The number of amateur publications with interesting content is rather small today.

I recently read the newsletter at <https://www.zeroretries.org/p/zero-retries-0205>.

Inside it, at paragraph "Data Repeaters", there are some statements about the data transfer features of the DMR standard that I consider incorrect, and would rather like they would be amended for the sake of not propagating incorrect information in the amateur community. Specifically, I mean:

DMR has a data option, though it's never been reasonably defined, that I've seen.

In fact, the DMR standard defines very well in TS 102 361-1 and TS 102 361-4 the following data packet protocols:

1. Confirmed data packet transfer (Base Station - BS or Mobile Station - MS acknowledges receipt of specific data blocks, only data blocks lost are re-transmitted by originator)
2. Unconfirmed data packet transfer (self explanatory)
3. Raw short data
4. Defined Data
5. Unified data transport (used by Short Message Service - SMS bearer services and registration / call control services on the Tier III control channel)

These Layer 2 data transfer protocols enable the following:

- SMS services between MS units and between MS units and gateway to other types of services or dispatch

consoles

- Internet Protocol - IP bearer services: arbitrary data encapsulated in IP transport (UDP datagrams being the most frequent usage, but TCP and other formats could also be possible)
- Call line information, system messages, talkgroup provisioning for MS units

Technical references:

https://www.etsi.org/deliver/etsi_ts/102300_102399/10236101/02.04.01_60/ts_10236101v020401p.pdf

Sections

- 8.0 DMR Packet Data Protocol (PDP) - Introduction
- 9.2 Data related Protocol Data Unit - PDU description

https://www.etsi.org/deliver/etsi_ts/102300_102399/10236104/01.09.01_60/ts_10236104v010901p.pdf

In fact, most manufacturers implement a proprietary protocol on top of one of these data transfer methods, frequently on top of IP/User Datagram Protocol - UDP, as is the case with popular Anytone radios. The type of data messages sent by these radios are very well described here:

<https://github.com/carpaldolor/DMRText>

I have written code based on that document and the DMR standards that can parse and convert between various data formats sent by these radios.

The easiest to understand DMR data protocol is *Unified* Data Transport which is used for Tier III SMS messages as well as other system services. I have written a fully open source implementation of this data protocol inside the DMR Tier III trunking controller:

<https://github.com/qradiolink/dmrtc>

Furthermore, I am currently working towards an open source implementation of DMR IP bearer services for MS units (using Software Defined Radio - SDR hardware), largely based on Jonathan Naylor's code libraries for DMR. These DMR services allow an IP link to be established either directly between units or via BS infrastructure.

To conclude, the DMR standard defines data transfer protocols rather well, and manufacturers are also free to add their own proprietary features on top of the standard, however these are built on a solid open base.

If you would like further information on this topic, I am at your disposal, having worked on both an open source implementation of the DMR trunking protocol and an open source DMR transceiver using SDR hardware, work which I try to document in open-access articles for the benefit of amateurs everywhere:

<https://qradiolink.org/DMR-tier-3-trunked-radio-BTS-software-defined-radio.html>

<https://qradiolink.org/open-source-DMR-transceiver-implementation.html>

...

N8GNJ again:

My questions to YO8RZZ:

If data *is* so well defined in the DMR specification...

Why don't we see more data capabilities in DMR radios?

I've seen data capability in videos and documentation for Mototrbo and Hytera. Connect a computer to one of their radios, load their respective software, and easily send data and text messages, *but only to other stations that are similarly equipped*.

Is it just that Motorola and Hytera did a good job, and the other manufacturers of DMR radios just don't bother?

Is it just that manufacturers of Amateur Radio DMR radios build them too cheaply (don't implement data capabilities)?

That is what has been puzzling me, bothering me about data over DMR. If data capability is inherent in the specification of DMR, then why don't we see *more data over DMR capability*?

YO8RZZ's Reply:

I think it is a problem of product market fit.

The cheaper radios that are generally popular in the amateur community have as a primary market small businesses and amateurs. These type of customers do not use or demand more advanced features of the standard, and in some cases may not even know they exist in order to demand them (in the case of the more technical amateur market).

On the other hand, more expensive radios from established brands have as customers large businesses and even smaller governmental services. This type of organization does need these features, and manufacturers do market them, perhaps as a cheaper alternative to more expensive options like TETRA.

I think price is also a big factor. Implementing all the advanced features of the [DMR] standard requires more expensive software development and [Quality Assurance - QA] pipelines, probably a more powerful computing platform on the radio itself, so this reflects in the pricing.

DMR became quite popular with amateurs because simple terminals were pretty cheap, and did their simple job fairly well. If DMR radios would have been as expensive as the fanciest D-Star radio, I don't know if it would have gotten that popular.

If the manufacturers of cheaper radios had more demand for more advanced features, perhaps they would be able to add them while keeping the price point down.

N8GNJ for the close:

Finally, *from YO8RZZ's deep knowledge*, I now have an understanding of Data over DMR, as in "it's possible, but not easy, and not built-in to every DMR radio".

To reiterate, *my interest* in data over DMR is primarily because there are now hundreds, perhaps thousands of DMR repeaters deployed in Amateur Radio. And, potentially, those Amateur Radio DMR repeaters could be used for data communications.

Per the information in this article, it would seem possible to create (inexpensive?) DMR data (only) radios such as the [Maxon SD-670D Series Digital DMR/Analog RF Data Modem](#) that could use one, or both DMR time slots for data communications over a repeater. It remains to be seen if that data can be passed over DMR repeaters without disruption.

My profound Thanks to Adrian Octavian Musceac YO8RZZ for providing such a great response to my request for information about data over DMR.

See the ZR > BEACON article below about YO8RZZ's QRadioLink project.

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2025 June - State of the APRS Foundation (YouTube)

By Steve Stroh N8GNJ

Someone has to report out what is happening in APRS Foundation.

To date, this recording of a Zoom meeting on 2025-06-22 is the *only public information available* about the *current* “State of the APRS Foundation”. The [APRS Foundation website](#) is woefully out of date, with the *only* update in months was to delete any mention of Jeff Hochberg W4JEW, who was one of the founders and first President of APRSF. There have been no updates to the [APRS Foundation email list](#) (other than to announce this Zoom meeting). Etc.

Fortunately, the meeting was recorded, and it was made available on the brand new [APRS Foundation YouTube channel](#) (Kudos for that). And with a YouTube video, there’s a YouTube automatically generated transcript.

Solely from my perspective, there were three significant takeaways from this meeting.

The first takeaway is that there are new participants in APRSF leadership.

Newly “Elected” APRSF Directors (see slide at 7:09)

- Pete Loveall AE5PL
- Don Rolph AB1PH
- Ron Startzel KB5LNC

Joining existing APRSF Directors:

- John Tarbox WA1KLI (now President)
- John Langner WB2OSZ (now Vice President)
- Jason Rausch K4APR (now Vice President)

Contacting APRS Foundation With Your Input

The second takeaway is that the preferred form of contact to let the APRS Foundation Directors / Officers know what you (especially actual, paid members of APRSF) are thinking, is to use the [Contact Us form](#) on the APRS Foundation web page. It was claimed that any information submitted there will be copied to each Director. While

you will get an automated reply confirming your message submission... I *speak from experience* that you probably will not get any personal response from any of the APRSF Directors.

Consolidating the Many “Variants” of APRS Specifications

The third takeaway is the progress to date of the work of consolidating the myriad “drifts” of various APRS implementations over the course of 25 years since the initial APRS Protocol Specification was completed. Since then, that specification has never been updated.

Unfortunately, it’s sadly indicative of how much credibility APRS Foundation is squandering to note that John Langner WB2OSZ published a fantastic article on the How APRS Works website explaining about those myriad “drifts” of the APRS Protocol Specification - **APRS101.pdf is Obsolete**. But, unless you are aware of *that specific URL* - <https://how.aprs.works/aprs101-pdf-is-obsolete/>, you won’t be able to find that article. If you look at the top level URL - <https://how.aprs.works/>, the latest article is from 2025-02. Clicking on any other link, including **Specification** in the lower right corner, does not show this great article.

I discussed this article briefly in **Zero Retries 0207** - APRS101.pdf is Obsolete.

On the Zoom call, WB2OSZ’s work on the “2025 consolidated APRS Protocol Specification” (my terminology) was (in my opinion), briefly, and way too casually discussed. While it was clear that APRS Foundation members were “encouraging” WB2OSZ’s work, that work was being treated as *WB2OSZ’s personal project*, and was not considered to be, and not officially endorsed as a project of the APRS Foundation.

At that point... I got involved in the conversation because I was frustrated that it did not seem that WB2OSZ’s work was being treated with the importance that it deserved. That, basically, *if there is not a solid, up-to-date APRS Protocol Specification*, then APRS cannot evolve because it’s fragmenting into different, potentially incompatible implementations.

What follows is a lightly cleaned up, reformatted transcript of my exchange with WA1KLI. None of my cleanup of the transcript is intended to change the meaning, or omit significant dialog. [Conversation begins at 40:44](#).

N8GNJ: I’m completely mystified why the leadership of the Foundation wants to keep a hands-off approach to the protocol specification that to me is the primary thing that there is about APRS. If you keep allowing, or you keep encouraging the splintering of the standards... John bless him, he's doing a fantastic job, but in the end he's one person. In my opinion the Foundation should be publicly, actively endorsing [John’s work] and it should be a project [of the Foundation]. Just bringing [the specification] up to date with what has already been done ought to be an official project of the Foundation. *Changing* the specification going forward, that's a completely different thing and yes maybe there should be an independent agency. But there isn't one; there's nothing like that. You guys *are* APRS for all intents and purposes. If you defer on this then... you're just [Public Relations]. Sorry, done.

WA1KLI: Well let me respond to that Steve; and help me to understand. I believe you made the point there was it one critical mission you feel we should do is is consolidate the current specification and get it published and unified which is separate from evolving it to the next version moving forward. Is that correct?

N8GNJ: Partially, yes. But it also ought to be officially endorsed, that what John is doing should be officially endorsed as a project of the Foundation, not hands off. You're endorsing him as an individual and his efforts. You're not saying that [what John is doing] is a project of the APRS Foundation.

WA1KLI: Well this is may be a distinction in name only in that John is a member of the Foundation now he's taking the lead on it. In other words we don't want to detract from what he's doing and we're letting him do it. Our intention is to formally adopt it once he publishes it. Does that help, Steve?

N8GNJ: If the intent is that once John has completed his efforts and you will endorse this formally as the Foundation's recommended protocol specification, then yes that answers my complaint.

WA1KLI: That absolutely is our intent Steve and and just to you know I don't want to dilute that in any way but the thing that needs to be recognized is that there are players like Kenwood, like Japan Amateur Radio League, so that when we endorse something, we can't force other people to adopt what we endorse. We can endorse it, but that's the limit of what we can do at this point. Is that fair, Steve?

N8GNJ: Kenwood is free to do whatever they want. No, I'm not saying you have any authority to force an implementation. But you have the most gravitas of any APRS entity there is at the moment - if you choose to use it. And by using it, you say "this is the Foundation's recommended APRS protocol standard".

WA1KLI: That's exactly the wording we'll use.

N8GNJ: *This* is the *very first time* the Foundation has ever stated that publicly. There has been no recognition of this until just now. So, *please* put that in writing on the website.

WA1KLI: We will do that. We will put that in writing with those exact words. Steve, this is, I believe, the first time we've done an open forum like this isn't it Jason?

K4APR: It is that's why we...

WA1KLI: That's one of the key reasons we're doing it. We want to get out and answer these questions. And you're right you're right Steve, it would have been great if we'd done a lot of stuff sooner but we're trying to do what we can at this point. So thank you Steve for bringing that up.

...

There was additional discussion about a "2025 consolidated APRS Protocol Specification" (again, my terminology) but I decided not to engage further as I'd gotten my primary point across, that the APRS Foundation should put its name and recommendation behind WB2OSZ's excellent work.

But it was frustrating to hear conflation that an up-to-date APRS Protocol Specification, *codifying what has already been discussed and implemented since the original APRS Protocol Specification 25 years ago*, is equivalent to "dictating to others" that "*their* APRS implementation is *wrong*".

That's not the case! Merely, "this is the *APRS Foundation's recommendation* of a "2025 Consolidated APRS Protocol Specification. Your preferences and implementations may vary."

At least with an APRS Foundation "2025 Consolidated APRS Protocol Specification", those that *want* to build new implementations of APRS technology will have a solid, *complete* APRS Protocol Specification to work from... if they choose to do so.

As for future changes and updates to the APRS Protocol Specification... perhaps it's time to revisit my *imagined* Amateur Radio Standards Organization - ARSO. Please read that entire issue for context.

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By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

Update on "Available for Amateur Radio" Power Amplifiers

John Simmons NI0K via email:

In my previous commercial experience with paging transmitters, in addition to TE Systems [mentioned in **Zero Retries 0207** - TE Systems RF Power Amplifiers for Amateur Radio] there are two other vendors that offer Radio Frequency (RF) power amplifiers covering the Amateur Radio VHF / UHF bands:

[Crescend Technologies - LMR and Commercial Communications](#)

[Henry Radio - Solid State RF Power Amplifiers](#)

FYI, in commercial use, the primary failure mode of high power (300+ watts) RF power amplifiers is from temperature cycling. Heating up (significant use), then cooling down (little or no use), repeated over and over. In such usage scenarios, solder connections and power transistors become problematic. If the use case supported the power amplifiers to be on full time, there were fewer power amplifier failures.

Thanks so very much for your newsletter. You manage to bring nuggets to my inbox of things I really want to know.

I'd completely forgotten about Henry Radio! It's cool that such a [storied name in Amateur Radio](#) is still with us at least in some capacity for Amateur Radio.

Good to know that this wide range of power amplifiers are available for use in our Amateur Radio VHF / UHF bands.

One of the reasons I decided to mention TE Systems products was that they offer a few power amplifiers with input drive levels as low as 100 mW, perhaps compatible with lower output power of Software Defined Transceivers and other low power radio systems such as IP400's initial units. I didn't see such an option in Crescend's or Henry Radio's products (lowest input drive levels are 1 watt).

#

[QRadioLink - Multimode Software Defined Transceiver Application](#)

QRadioLink is a GNU/Linux multimode (analog and digital) SDR (software defined radio) transceiver application using the Internet for radio to VOIP bridging (radio over IP), built on top of [GNU radio](#), which allows experimenting with software defined radio hardware using different digital and analog radio signals and a Qt5 user interface.

Features:

- DMR modulator and demodulator capable of operating in repeater mode or DMO with LimeSDR family devices and using Codec2 as the vocoder
- M17 digital voice modulator and demodulator
- MMDVM base station mode with TDMA support (DMR, System Fusion, D-Star, M17) using LimeSDR and Ettus USRP family devices
- ETSI compliant DMR base station (repeater) supporting double timeslot TDMA with LimeSDR and Ettus USRP family devices and MMDVM-SDR.
- Multi-channel / multi-carrier MMDVM system using LimeSDR and Ettus USRP family devices. Up to 7 carriers (analog FM, DMR, System Fusion, D-Star, M17 modes) supported in 200 kHz bandwidth, duplex mode. Number of channels can be configured between 2 and 7. Channel separation configurable to 12.5 or 25 kHz. Channel assignment is flexible and user defined.
- DMR tier III trunked radio base station using LimeSDR and Ettus USRP family devices - can be combined with other modes (analog FM, DMR, System Fusion, D-Star, M17) in a flexible configuration.
- FreeDV digital voice modulator and demodulator (currently supports only 1600, 700C, 700D and 800XA modes)
- Wideband digital voice streaming over the Internet with the [Opus](#) audio codec
- Digital modulation: **M17 digital mode, FreeDV 1600, FreeDV 700C, FreeDV 700D, FreeDV**

800XA, BPSK, DQPSK, 2FSK, 4FSK, GMSK

- Analog modulations: FM (12.5 kHz), narrow FM (6.25 kHz), SSB, AM, Wide FM (broadcast, receive-only)

And many more features - see the link.

This is a project by Adrian Octavian Musceac YO8RZZ - see the above article **Details About Data Over DMR**.

I'm constantly amazed at the amazing technological innovation I find in Amateur Radio from talented, motivated people like YO8RZZ.

I particularly enjoyed [this mention \(FAQ section\)](#):

Is the packet radio system within QRadioLink compatible with other existing amateur packet radio modes and / or FM radios?

No, the packet radio modem is not compatible with FM radios and 1200 / 9600 baud amateur radio packet.

The receiver needs to be able to demodulate in a bandwidth of at least 1 MHz to receive this radio packet mode.

Furthermore, the Internet packet modes in QRadioLink do not even use the same data link layer. Instead of AX.25 frames, QRadioLink sends Ethernet frames over the air. This means that you do not need AX.25 Linux kernel support to create an IP link with QRadioLink. Also, both the 4FSK and DQPSK packet radio modes require a full duplex transceiver, or at least two devices (a semi-duplex transceiver and an RTL-SDR receiver for example).

Wow... that is some *next generation thinking* using Ethernet frames over the air, taking full advantage of the capabilities of Software Defined Transceivers, rather than just emulating legacy modes designed for legacy voice radios.

A project I have been hoping to see is "GNU Radio for Hams" that would be a "packaged app" of GNU Radio with popular "blocks" for Amateur Radio modes. With built-in support for modes such as QRadoLink would seem to be such a project. And what's really impressive to me is the copyright data on the site is 2017... at least some of the work on this project has been in progress for *eight years*!

#

[HackRF Pro Announced \(Pre-purchase\)](#)

Great Scott Gadgets blog:

HackRF Pro from Great Scott Gadgets is a Software Defined Radio peripheral capable of transmission or reception of radio signals from 100 kHz to 6 GHz. Designed to enable test and development of modern and next generation radio technologies, HackRF Pro is an open source hardware platform that can be used as a USB peripheral or programmed for stand-alone operation.

...

Compared to HackRF One, HackRF Pro introduces a host of new and updated features, including:

- Wider operating frequency range
- Improved RF performance with flatter frequency response
- Modern USB Type-C connector
- Built-in TCXO crystal oscillator for superior timing stability

- Logic upgrade from a CPLD to a power-efficient FPGA
- Elimination of the DC spike
- Extended-precision mode with 16-bit samples for low sample rates (typical ENOB: 9-11)
- Half-precision mode with 4-bit samples at up to 40 Msp/s
- More RAM and flash memory for custom firmware
- Installed shielding around the radio section
- Trigger input and output accessible through clock connectors
- Cutout in the PCB provides space for future add-ons
- Improved power management
- Enhanced RF port protection
- Facility to hardware-disable transmit mode

Pre-order price from several vendors is \$400. I was discussing this with a Zero Retries reader who felt it was overpriced compared to HackRF variants available from China, to which I replied that Great Scott Gadgets actually provides support for their products, and the performance is consistent from unit to unit (you generally know it's going to work). Not to mention there's a lot to be said for a well-known, understood, stable, widely used, and well-documented unit when you're doing development.

Great Scott Gadgets clearly understands and is taking advantage of that value proposition:

Software that works with HackRF One is already compatible with HackRF Pro. We designed HackRF Pro for backward compatibility, following the same basic architecture of HackRF One but with many small enhancements. Prior to shipping HackRF Pro, we will publish a migration guide that will show software developers how to take advantage of certain new capabilities of HackRF Pro, but out-of-the-box HackRF Pro will behave like HackRF One with superior performance. In addition to host software compatibility, our migration guide will address firmware, allowing developers to port custom firmware to the new platform and take advantage of its unique capabilities.

Thus, to me, this price point especially with the improved performance versus the [HackRF One](#) *seems entirely reasonable*.

One minor downside to the HackRF Pro is:

HackRF Pro has an injection molded plastic enclosure.

Bummer. Maybe it's just me, but I like RF units (both receiving and transmitting) to have metal cases, and I would pay extra for an optional metal case.

A feature of the HackRF One and now the HackRF Pro that I was unaware of is this brief mention in the introduction:

... that can be used as a USB peripheral or *programmed for stand-alone operation*.

Wow. Download software into the HackRF One / Pro and operate it *standalone*, such as perhaps a Software Defined Repeater or M17 radio? That is powerful, and (at least in my limited knowledge of Software Defined Transceivers - SDTs) unique. Almost every SDT I've read about requires a host computer for operation.

My thanks to [RTL-SDR Blog for the pointer to this item](#).

###

Checking in on the Universal Radio Test Instrument (URTI) Project

Since I was on the Great Scott Gadgets website, I took a quick look at their [URTI page](#).

In 2022-09, [ARDC awarded TAPR a grant of \\$296,760](#) for Great Scott Gadgets to do the development work for URTI:

This grant provides funds for Great Scott Gadgets to produce an open source design for a low-cost universal radio test instrument that can be used in place of several pieces of traditional test equipment. Great Scott Gadgets is a for-profit company with a mission to “put open source tools into the hands of innovative people”, closely aligned with the values of both TAPR and ARDC. Based on Software-Defined Radio (SDR) technology, the instrument will enable a new era of wireless innovation throughout the amateur radio community and beyond.

It’s now nearly three years later. While there was some results, achieved, and I don’t observe that there’s any recent progress on this project noted by the three parties.

ARDC - No progress or conclusion results noted on [ARDC’s page describing the URTI grant](#).

TAPR - I could not find any mention of this grant or the URTI in [TAPR’s Packet Status Register - PSR newsletter](#).

Great Scott Gadgets - No recent, significant progress is noted on Great Scott Gadgets’ [URTI page](#) or in:

You can view our current progress on URTI in the [lab notes repository](#) on GitHub.

I applaud ARDC for awarding Research and Development grants such as this.

And I recognize that sometimes R&D (and other) projects just don’t work out.

But it’s frustrating... *and confusing to Amateur Radio developers* that significant grants awarded by ARDC just... *dissipate*? The problem that uncompleted (?) projects like this cause is that other developers look at ARDC’s awarded grants, see one that is similar to the idea or project they have in mind to request funding for, and there’s no public information on how that project went after the grant was awarded. *What really happened? Maybe we shouldn’t attempt our project because this earlier one apparently didn’t succeed?*

It’s not like ARDC just doesn’t know what happened with past grants. More than one year ago, ARDC formed a **Grants Evaluation Team** to do such followup on previously awarded grants. ARDC’s Director of Grantmaking Chelsea Párraga KF0FVJ is the Staff Lead for this team of eight volunteers.

I think it would be helpful if ARDC released the results of their findings on grants such as the URTI project.

#

TETRA Supports Single Frequency Repeater Mode

Comment, and exchange from Zero Retries 0207:

Werner OE1WRS:

Tetra uses single frequency repeater in DMO mode, we do have a number of Tetra repeaters in OE land (and other countries) which work on one frequency without duplexer etc. those are even networked so when you talk on one in one city you are also heard on the other repeaters in other cities (or on mountains). Most Tetra terminals can act as repeater....

Steve Stroh N8GNJ:

Werner - Thanks for that info. Will correct my statement saying that Tetra can't do TDD SFR.

For those, like me who aren't very familiar with TETRA, see <https://www.teltronic.es/en/what-is-dmo/>

In radio communications, unlike Trunked Mode Operation, TMO, in which the transmissions are made through a TETRA network infrastructure, the DMO, Direct Mode Operation, describes the ability of TETRA radio terminals to communicate among them operating independently from the network, as if they were simple walkie-talkies.

However, the most frequent use of the DMO is to create an extension of the network allowing communications in areas where there isn't coverage. Through gateways, DMO users can maintain contact with TMO users. In this way, the radios operate like mini base station that can provide service to others that are outside the network.

I'm not being facetious in saying that the more I encounter and learn about [TETRA](#), the more it seems like "the wonder mode" of radio systems. While Digital Mobile Radio (DMR) was designed by ETSI for commercial use, TETRA (also developed by ETSI) is designed for government (including military) use.

For Zero Retries, TETRA is a "fertile area of future research".

Leave a comment

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Comments Summary From Previous Issue

Comments from Zero Retries 0207:

- Comment on older "receive, record, replay" Single Frequency Repeaters (and the learning curve to use them).
- Mention of a YouTube video regarding Polar Modulation.
- Another great callsign lookup service.
- Agreement that designed-for-repeater-usage hardware for Time Division Duplex (TDD) Single Frequency Repeaters (SFRs) is a welcome development.
- Kudos to John Langner WB2OSZ, and mention of his excellent Dire Wolf Software TNC's capabilities.
- Discussion of TETRA - see ZR > BEACON item above.

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See the **Zero Retries Boilerplate** page for significant acknowledgements and other information relevant to Zero Retries. For new readers of Zero Retries, that page, and the **About Zero Retries** page has useful information to check out.

My ongoing *Thanks* to:

Tina Stroh KD7WSF for, well, *everything*!

Jack Stroh, Late Night Assistant Editor Emeritus

Shrekky Stroh, Late Night Assistant Editor In training

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Defined Receiver, Space Communications, **Steve Stroh**, **TETRA**, Universal Radio Test Instrument, URTI, **Zero Retries**, **Zero Retries Digital Conference**, **ZRDC 2025**

*Keywords in **Bold** are regular mentions in each issue.*

Footnotes for this Issue

To see the relevant sentence for the footnote, just click the footnote number.

[1](#)

In the US, the *primary* allocation of the 420-450 MHz band is the US government / US military, for a variety of uses, primarily various RADAR systems. Other uses mentioned are telemetry and location systems.